Krautkramer Branson

DME

Operating Manual

Operating Manual

for the

DME

Ultrasonic Thickness Gauge

Part No. 021-002-550 Rev. B

Important Notice

The following information must be read and understood by any user of a Krautkramer Branson ultrasonic thickness gauge. Failure to follow these instructions can lead to errors in thickness measurements or other test results. Decisions based on erroneous results can, in turn, lead to property damage, personal injury or death.

General Warnings

Proper use of ultrasonic test equipment requires three essential elements:

- Selection of the correct test equipment.
- Knowledge of the specific "test application requirements."
- Training on the part of the instrument operator.

This operating manual provides instruction in the basic set up and operation of the KB thickness gauge. There are, however, additional factors which affect the use of ultrasonic test equipment. Specific information regarding these additional factors is beyond the scope of this manual. The operator should refer to textbooks on the subject of ultrasonic testing for more detailed information.

Operator Training

Operators must receive adequate training before using ultrasonic test equipment. Operators must be trained in general ultrasonic testing procedures and in the set up and performance required by a particular test. Operators must understand:

- Soundwave propagation theory.
- Effects of the velocity of sound of the test material.
- Behavior of the sound wave where two different materials are in contact.
- Areas covered by the sound beam.

More specific information about operator training, qualification, certification, and test specifications is available from various technical societies, industry groups, and government agencies.

Testing Limitations

In ultrasonic testing, information is obtained only from within the limits of the sound beam. Operators must exercise great caution in making inferences about the test material outside the limits of the sound beam. For example, when testing large materials it may be impossible or impractical to inspect the entire test piece. When a less-than-complete inspection is to be performed, the operator must be shown the specific areas to inspect. Inferences about the condition of areas not inspected, based on data from the evaluated areas, should

only be attempted by personnel fully trained in applicable statistical and probability techniques. In particular, materials subject to erosion or corrosion, in which conditions can vary significantly in any given area, should only be evaluated by fully trained and experienced operators.

Sound beams reflect from the first interior surface encountered. Because of part geometry and overlapped flaws or overlapped surfaces, thickness gauges may measure the distance to an internal flaw rather than to the back wall of the material. Operators must ensure that the entire thickness of the test material is being examined.

Ultrasonic Thickness Measurement Critical Operating Procedures

The following operating procedures must be observed by all users of ultrasonic thickness gauges in order to minimize errors in test results.

1. *Calibration of Sound Velocity*

The principle of operation of an ultrasonic thickness gauge is that the instrument measures the time of flight of an ultrasonic pulse through the test piece and multiplies this time by the velocity of sound in the material. Thickness measuring error is minimized by ensuring that the sound velocity to which the instrument is calibrated is the sound velocity of the material being tested. Actual sound velocities in materials often vary significantly from the values found in published tables. In all cases, best results are obtained if the instrument is calibrated on a velocity reference block made from the same material as the test piece; this block should be flat, smooth and as thick as the maximum thickness of the test piece.

Operators should also be aware that the sound velocity may not be constant in the material being tested; heat treating, for example, can cause significant changes in sound velocity. This must be considered when evaluating the accuracy of the thickness provided by this instrument. Instruments should always be calibrated before testing, and the calibration should be checked after testing, to minimize testing errors.

2. *Probe Zero Procedure*

The probe zero procedure must be performed as described in this manual. The probe zero block should be clean, in good condition, without noticeable wear. Failure to properly perform the probe zero procedure will cause inaccurate thickness readings.

3. *Effects of Temperature on Calibration*

Temperature variations change the sound velocity of materials and transducer delay lines and, therefore, zero calibrations. All calibrations should be performed on-site, and with test blocks at the same temperature as the test piece, to minimize errors due to temperature variations.

4. *Transducer Selection*

The transducer used in testing must be in good condition without noticeable wear of the front surface. Badly worn transducers will have a reduced effective measuring range. The specified range of the transducer must include the complete range of thicknesses to be tested. The temperature of the material to be tested must be within the transducer's temperature range.

5. *Use of Couplants*

Operators must be familiar with the use of ultrasonic couplants. Testing skills must be developed so that couplant is used and applied in a consistent manner to minimize variations in couplant layer thickness and errors in test results. Calibration and actual testing should be performed under similar coupling conditions, using a minimum amount of couplant and applying consistent pressure on the transducer.

6. *Doubling*

Ultrasonic thickness gauges will, under certain conditions, display readings which are twice (or, in some cases, three times) the actual material thickness being measured. This effect, commonly known as "doubling," can occur below the minimum specified range of the transducer. If the transducer being used is worn, doubling is possible at a thickness greater than the minimum specified range.

When using a new transducer, any reading which is less than twice the minimum specified range of the transducer may be a "doubled" reading, and the thickness of the material being tested should be verified by the use of other methods. If the transducer shows any sign of wear, doubling may occur at a thickness greater than twice the minimum specified range. This thickness should be determined by calibrating the instrument/transducer combination on reference blocks that represent the complete range of possible thicknesses that may be encountered in testing. This is particularly important when the test piece is being ultrasonically measured for the first time or in any case where the history of thickness of the test specimen is unknown.

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Warranty

When used in accordance with the manufacturer's written instructions and under normal operating conditions, Krautkramer Branson's (KB) test instruments are guaranteed to be free from defects in material and workmanship for a period of two (2) years from date of shipment. KB will repair free of labor and material charges any unit which proves defective within two years from date of original shipment by KB or by an authorized representative or distributor.

All repair work will be made FOB Lewistown, Pennsylvania, or at a Factory Trained Service Center as advised by KB, provided the defective unit is returned properly packed with all transportation charges prepaid. Any and all equipment replacement will be at the sole discretion of KB.

This warranty shall not apply to equipment subjected to misuse or abuse, improper installation, alteration, neglect, or accident. Excluded from this warranty are expendable items such as transducers, interconnecting cables, batteries, and vacuum tubes when used in the instrument. Accessory items such as recorders, etc. will be covered under the original manufacturer's warranty as given to KB.

This warranty is limited to the original purchaser and is not transferrable. No other warranty, expressed or implied, is made.

Service

Every effort has been made to provide you with a reliable product. However, should service become necessary, KB has established a number of Factory Trained Service Centers. For the location of the nearest facility, refer to Section 6 or contact:

Manager of Customer Service
Krautkramer Branson
50 Industrial Park Road
P.O. Box 350
Lewistown, PA 17044

Telephone: (717) 242-0327
(717) 242-0331

Telex: 842-354

Telefax: (717) 242-2606

1.0 Introduction

1.1 Foreword

The DME Ultrasonic Thickness Gauge is a handheld, microprocessor controlled instrument designed for general thickness measurements on a variety of equipment having access to one side only. It is especially applicable to the measurement of remaining wall thickness on tubes, pipes, pressure vessels, and other parts subject to wall thickness loss due to corrosion or erosion.

Special Features of the DME:

- Rugged, sealed case and keypad assure reliable operation.
- Push button probe zero and one point, off block calibration simplify setup.
- Automatic V-path error correction compensates for non-linearity of dual element probes.
- Automatic receiver gain control. Gain is adjusted automatically to facilitate measurements on ultrasonically "noisy" materials, such as aluminum.
- Measurements can be displayed in inches or millimeters. Metric mode offers a choice of 0.1 mm or 0.01 mm resolution.
- Electroluminescent backlight enables use in low light conditions.

1.2 How the DME Measures Thickness

The DME operates on the pulse-echo principle, similar to sonar. A short ultrasonic pulse is transmitted into the part by a probe (transducer). The pulse travels through the material under test until it encounters an interface, that is a material with substantially different physical characteristics, such as air or liquid, at the back surface of the part (Figure 1). At the interface, the pulse is reflected back to the probe. The time needed for the pulse to make this round trip is divided by two and multiplied by the velocity of sound in the material under test. The result is the thickness of the material.

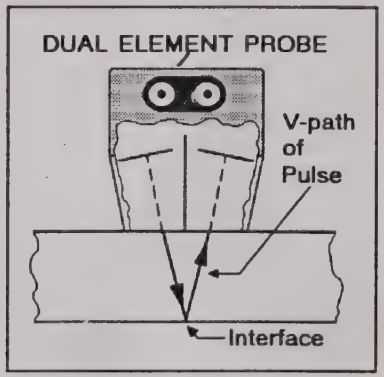


Figure 1

2.0 Operation

2.1 Battery Installation

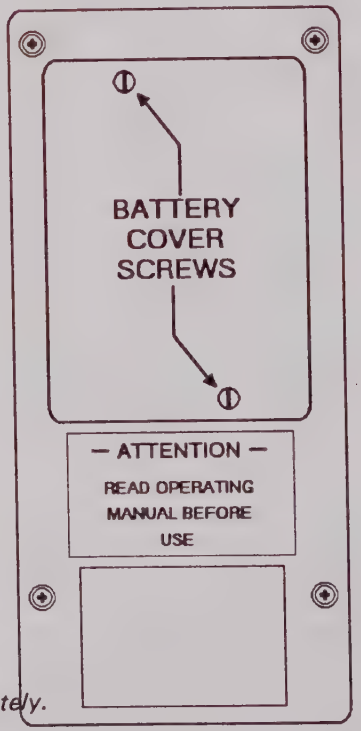
To install batteries in the DME, loosen the two battery cover screws on the back of the instrument and remove the cover.

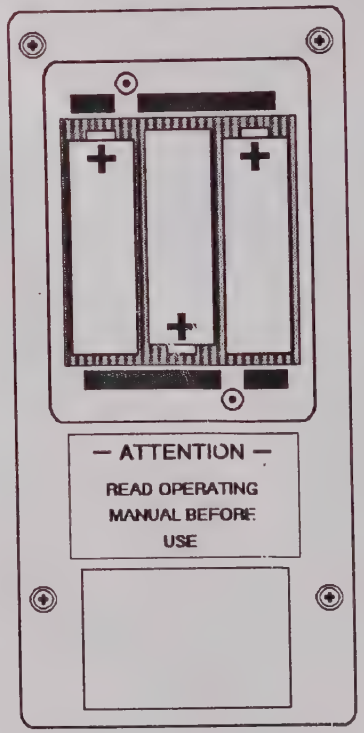
Insert 3 "AA" alkaline batteries as shown. The DME is protected against accidental reversal of battery polarity. If the batteries are installed with the polarity reversed, no damage to the DME will occur, but the instrument will not operate.

Replace the battery cover and tighten the screws.

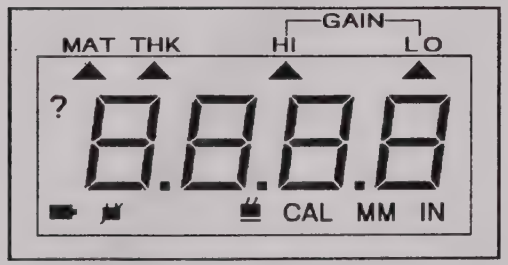
NOTE:

When the low battery indicator (➡ - Section 2.2) lights, batteries should be replaced immediately.





2.2 Display Symbols



MAT ▲ Indicates that the displayed value is a material velocity of sound (Material Velocity mode).

THK ▲ Indicates that the displayed value is a thickness (Thickness Measurement mode).

HI ▲ Indicates that the DME receiver is in high gain manual override mode (no caarat ⇒ automatic).

LO ▲ Indicates that the DME receiver is in low gain manual override mode (no carat ⇒ automatic).

? Over range indicator lights when the measured thickness exceeds 9.999 inches.

Low battery indicator lights when batteries should be replaced.

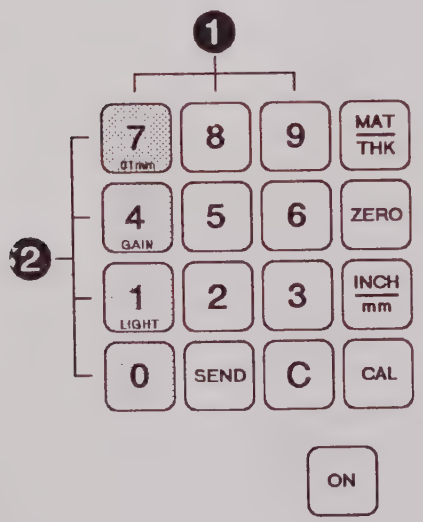
High resolution indicator lights when the DME is switched into high resolution (.01 mm) metric mode.

Coupling indicator lights when satisfactory coupling between probe and test piece has been achieved.

CAL CAL annunciator flashes when the DME is in the calibration mode,i.e **CAL** key has been pressed.

MM/IN Indicate whether the displayed value is in inches (IN) or millimeters (MM).

2.3 Keyboard Controls



❶ Numeric keys 0 through 9 are used to enter material thickness or velocity values for calibration.

MAT/THK — **MAT/THK** key selects whether displayed value is material thickness or velocity.

ZERO — **ZERO** key prepares the DME for the probe zero procedure.

INCH/mm — **INCH/mm** key selects the unit of measure, either inches or millimeters (10^2 in/s or m/s for velocities).

CAL — **CAL** key prepares the DME to receive a calibration value.

C — **C** key clears the display if an incorrect value is entered during calibration.

SEND — **SEND** key transmits the displayed thickness or velocity value to KB's DR1 Data Recorder or other compatible data logger.

ON — The **ON** key switches the DME on. The instrument automatically shuts off after approximately four minutes of non-use.

❷ Numeric keys 0, 1, 4, and 7 have two functions. In addition to use as numeric keys (ref. ❶ above), they are used to activate the special features described in Section 3.

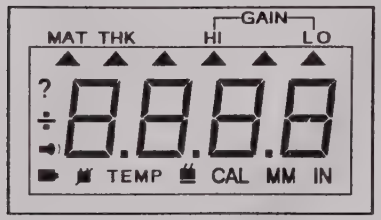


Figure 2

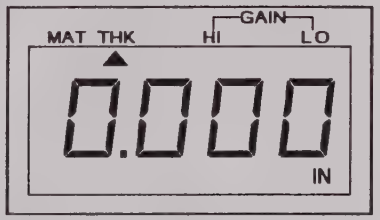


Figure 3

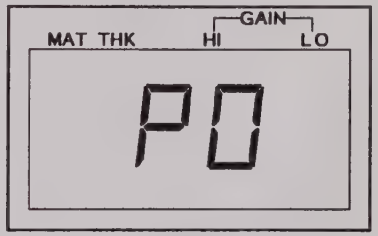


Figure 4

2.4 Getting Started

Connect a probe to the instrument.

Press the **ON** key.

The DME will perform a brief display test. All segments of the display will light (Figure 2).

After the display test is completed, the DME will display 0.000 (or the last velocity value stored by the instrument). See Figure 3.

The instrument is now ready for the probe zero procedure.

Press the **ZERO** key.

The instrument will display PO (Figure 4).

Proceed to Section 2.5.

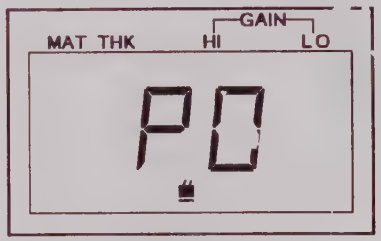


Figure 5

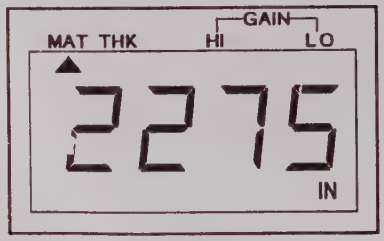


Figure 6

2.5 Probe Zero Procedure

Apply a small amount of couplant to the built-in PROBE ZERO block on the front panel of the DME,and couple the probe to it.

NOTE: *The built-in probe zero block is not to be used as a calibration standard.*

The coupling indicator will light (Figure 5).

After a few seconds, a material velocity will be displayed. Note the carat beneath MAT in the display (Figure 6).

The material velocity value displayed will be the last velocity value stored in the instrument and not necessarily the value 2275 (5779 in metric mode) shown in the above example.

The DME is now ready to calibrate to the material to be tested.

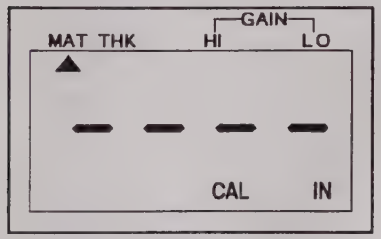


Figure 7

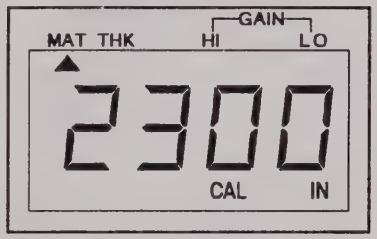


Figure 8

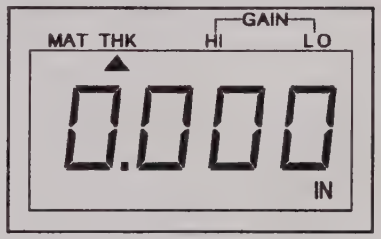


Figure 9

2.6 Calibration to a Known Velocity

Perform the probe zero procedure described on the previous page.

With a material velocity displayed, press the **CAL** key. The CAL indicator will light and a row of dashes will be displayed (Figure 7).

Use the numeric keys to enter the desired velocity, e.g. 2300. After the fourth digit is entered, the CAL indicator, seen in Figure 8, will be extinguished. The **C** key may be used to clear the display if an error is made while entering the first 3 digits.

Press the **MAT/THK** key to put the instrument in the thickness mode.

The DME is now ready to measure the thickness of parts with a velocity of .2300 in/μs (Figure 9).

Table 1: Typical Sound Velocities in Various Materials (Longitudinal Wave)

	in/μs	m/s		in/μs	m/s
Aluminum	.2500	6300	Nylon	.1000	2500
Brass	.1700	4300	Phenolic	.0560	1400
Cadmium	.1100	2800	Platinum	.1600	4100
Cast Iron	.1800	4600	Plexiglas	.1100	2800
Copper	.1800	4600	Polyethylene	.0700	1800
Epoxy Resin	.1100	2800	Polystyrene	.0930	2400
Glass (Crown)	.2200	5600	Polyurethane	.0700	1800
Glass (Window)	.2700	6800	Porcelain	.2200	5600
Gold	.1300	3300	Rubber (Butyl)	.0730	1900
Inconel	.2200	5600	Rubber (Vulc.)	.0900	2300
Lead	.0850	2200	Silver	.1400	3600
Magnesium	.2300	5800	Steel	.2300	5800
Manganese	.1800	4600	Tin	.1300	3300
Molybdenum	.2500	6300	Titanium	.2400	6100
Neoprene	.0630	1600	Tungsten	.2100	5300
Monel	.2100	5300	Zinc	.1600	4100
Nickel	.2200	5600	Zircaloy 2	.1900	4700

This information is provided for the convenience of the user and Krautkramer Branson assumes no responsibility for inaccuracies. Actual velocities depend on exact composition, temperature, and processing of each material.

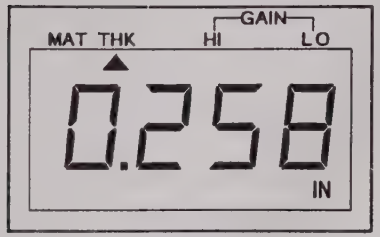


Figure 10

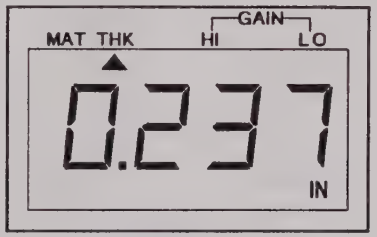


Figure 11

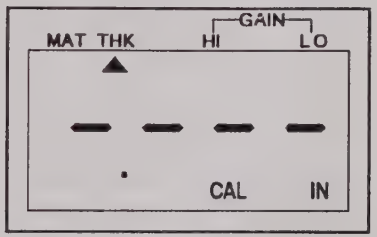


Figure 12

2.7 Calibration to a Known Thickness

Perform the probe zero procedure described in Section 2.5.

Note: The built-in probe zero block is not to be used as a calibration standard.

Press the **MAT/THK** key. The display will change to the thickness mode, showing the thickness of the PROBE ZERO block at the current velocity (Figure 10).

Couple the probe to a calibration standard (of the same material and velocity as the material to be measured) of known thickness. For best results, the thickness of the calibration standard should be equal to or slightly thicker than the upper end of your expected measuring range.

When a stable reading is obtained, remove the probe from the calibration standard (Figure 11).

Press the **CAL** key.

A row of dashes with a decimal point will be displayed (Figure 12).

Figure 13

Figure 14

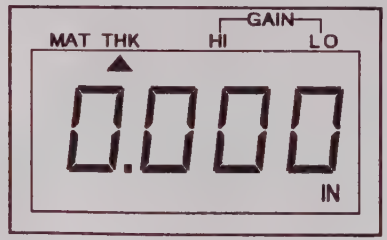


Figure 15

Use the numeric keys to enter the correct thickness value.

Four digits must be entered. For example, ¼ inch would be entered as 0250 (Figure 13).

After the fourth digit is entered, the DME will automatically display the new material velocity (Figure 14).

The **C** key may be used to clear the display if an error is made while entering the first three digits.

Press the **MAT/THK** key.

The DME is now calibrated and ready to measure test pieces of the same material and velocity as the calibration standard (Figure 15).

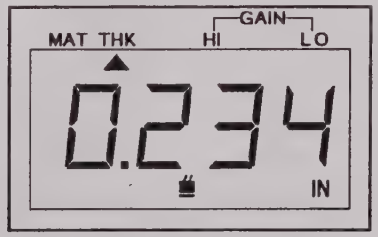


Figure 16

2.8 Wall Thickness Measurement

The following procedure applies to parts with ambient surface temperatures. Refer to Section 5.2 for information on taking measurements on hot surfaces.

Be sure that the DME is on and the probe zero and calibration procedures have been performed for the current probe and material to be measured (Sections 2.5 - 2.7).

The CAL annunciator must be off.

Remove any dirt, loose scale, or flaking from the test surface.

Spread a thin layer of couplant on the test surface and place the probe gently but firmly on the couplant surface.

Couplant must always be used when testing.

The coupling indicator (⏏) should light, as in Figure 16. Use firm, steady pressure to obtain a stable reading.

Read the thickness of the test material in the display (Figure 16).

If incorrect values occur repeatedly, check probe selection (Section 4.2) or contact the local Krautkramer Branson representative.

2.9 Recording Measurements

DME thickness measurements and velocity data can be recorded using Krautkramer Branson's model DR1 Data Recorder. Using the DR1 Data Recorder adds reliability to the recording of thickness readings in remote locations by avoiding the errors of misread and misrecorded numbers. Time and cost are reduced by eliminating manual recording and readings can be transferred efficiently to a serial printer for immediate documentation or to a computer for storage and analysis. Optional DATAMATE™ software programs provide two-way communications between the DR1 and a computer, simplifying the process of creating, editing, storing, and reporting data files.

To record data, connect the DR1 to the DME at the data output port, located next to the probe connectors. The connectors on the data input cable are labelled to assure correct orientation. Set up the DR1 according to the instructions provided with the instrument. Before attempting to send readings from the DME, be sure the DR1 is turned on and ready to record the data in the desired file and location number.

Figure 17

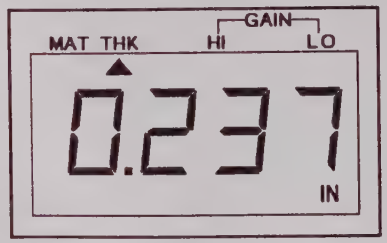


Figure 18

To send the current velocity setting to the DR1, press the **MAT/THK** key to display the velocity (Figure 17). Press the **SEND** key to transmit the displayed velocity. The DR1 responds with a beep to confirm that the data has been accepted.

To send a thickness reading, obtain the reading (Figure 18) using the procedure in Section 2.8. While the reading is displayed, press the **SEND** key to transmit. The DR1 responds with a beep to confirm that the data has been accepted.

3.0 Special Features

3.1 Backlight Control

The DME has an electroluminescent backlight to facilitate use of the instrument under low light conditions.

To enable the backlight, press the **0** and **1** keys simultaneously. Although the backlight has been activated, it will not light until the probe is coupled to the test piece and a reading is displayed. Battery power is conserved in this way.

When the probe is removed from the test piece, the backlight will remain on for approximately 5 seconds. This delay allows the operator to record the reading on Krautkramer Branson's model DR1 Data Recorder by pressing the **SEND** key, and to verify that the reading has been successfully transmitted.

To disable the backlight, again press the **0** and **1** keys simultaneously.

The backlight is also disabled by the automatic shut-off feature of the DME (approximately 4 minutes after the last reading). Therefore, it is necessary to re-enable the backlight when the instrument is turned on again.

Figure 19

Figure 20

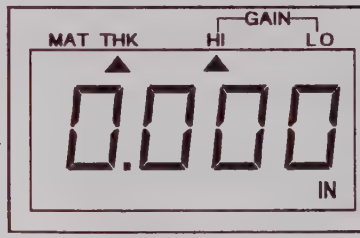


Figure 21

3.2 Receiver Gain Level Selection

Some acoustically "noisy" materials (e.g. aluminum) can be difficult to measure. The DME has selectable receiver gain to fa ilitate taking measurements on such materials. In normal operation, this gain selection is made automatically and the operator need take no special action. However, a manual override is available, if needed. In the automatic mode, no carat appears under GAIN HI or GAIN LO in the display (Figure 19). To override the automatic setting, press the **0** and **4** keys simultaneously. The receiver is now in low gain mode (Figure 20).

Press **0** and **4** again to put the receiver in high gain mode (Figure 21).

Pressing the **0** and **4** keys a third time restores the automatic gain selection function (Figure 19).

When the DME shuts off automatically (approximately 4 minutes after the last reading), the current gain level is retained so that the instrument returns to the same gain setting when turned on again.

3.3 High Resolution Mode

In normal operation, the resolution of the DME is .001 in/.1 mm. In some applications, it may be beneficial to have higher resolution in the display. For these applications, the DME offers a high resolution metric measuring mode where the displayed resolution is .01 mm.

To activate the high resolution mode, switch the display to metric units using the **INCH/mm** key.

Press the **0** and **7** keys simultaneously. Then press the **MAT/THK** key. The high resolution indicator lights and the display changes to 0.00 (Figure 22).

Press **0** and **7** again to return to the standard resolution mode.

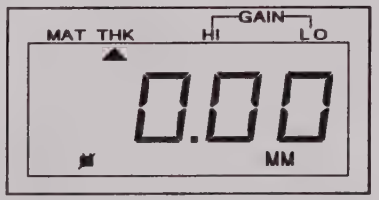


Figure 22

If the high resolution function is activated in the inch mode, the high resolution indicator lights, but there is no effect on displayed resolution (Figure 23).

If the DME shuts off automatically (approximately 4 minutes after the last reading) while in high resolution mode, the instrument will retain the setting. When the instrument is turned on again, it will still be in the high resolution mode.

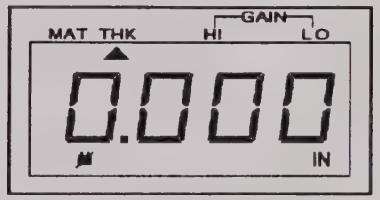


Figure 23

***NOTE:** The high resolution function requires higher power consumption and reduces battery life by approximately 30%.*

4.0 Specifications

4.1 DME Specifications

Operating Principle:	Ultrasonic, pulse-echo measurement method
Measuring Range:	0.030 inch to 9.999 inches; 0.5 mm to 300 mm; depending on probe selection and material under test
Displayed Resolution:	0.001 inch in inch units; 0.1 mm or .01 mm in metric units
Reading Stability:	Nominal measured value ±0.001 inch (0.025 mm) over the temperature range of the instrument
Linearity with KBA560 Probe:	±0.002 inch (±0.05 mm) when calibration point is ≤1.0 inch (25 mm); ±0.004 inch (±0.1 mm) when calibration point is >1.0 inch (25 mm)
Update Rate:	Approximately 5 Hz; 3 Hz in high resolution mode
Material Velocity Range:	Up to 0.9999 in/μsec; Up to 9999 m/sec
Displayed Information:	Unit of measurement (inches or millimeters) Coupling / no coupling Low battery indicator Over range indicator High resolution mode indicator Calibration mode indicator Thickness/velocity indicator High/low gain indicator

Display Type:	4 digit, 0.5 inch (12.7 mm) high, 7 segment Liquid Crystal Display with electroluminescent backlight
Probe Zero Block:	0.250 ±.002 inch (6.4 ±.05 mm)
Power Requirements:	3 each 1.5 volt, AA alkaline cells
Battery Life (Operating Time):	Up to 225 hours at 25% duty cycle; up to 100 hours when the backlight is enabled
Automatic Shut-off:	Approximately 4 minutes after last reading (last reading is held on display until new reading is taken or automatic shut-off occurs)
Temperature Range:	+10°F to +120°F (-10°C to +50°C)
Dimensions (LxWxD):	6.5 inches x 3.0 inches x 1.6 inches (165.1 mm x 76.2 mm x 40.6 mm)
Weight:	Approximately 14.5 ounces (0.4 kg), including batteries
Data Output:	Serial, asynchronous; 0, +5V TTL, 1200 baud, no parity, 8 data bits, 1 stop bit
Transducer Connectors:	Dual, Lemo #00
Automatic Receiver Gain Selection:	High Gain ≤ .2460 in/μsec (6250 m/s) Low Gain > .2460 in/μsec (6250 m/s)

NOTE: DME specifications are subject to change without notice.

4.2 Probe Specifications

Model	Probe Description	Nominal Frequency	Contact Diameter	Meas. Range	Temp. Range
FH2E	High Sensitivity Fingertip	8 MHz	.38" 9.6 mm	.030 to 2.0" .75 to 50 mm	<130°F <54°C
KBA560	General Purpose	5 MHz	.625" 15.9 mm	.060 to 8.0" 1.5 to 200 mm	<450°F <230°C
KBA571H	High Temperature	5 MHz	.44" 11.2 mm	.040 to 2.5" 1.0 to 63mm	<900°F* <480°C*
DA312	Thin Materials	10 MHz	.30" 7.6 mm	.030 to 1.0" .75 to 25 mm	<130°F <54°C
KB550FH	Fingertip	5 MHz	.375" 9.5 mm	.060 to 2.0" 1.5 to 50 mm	<130°F <54°C
KB550BTH	Boiler Tube	5 MHz	.375" 9.5 mm	.060 to 2.0" 1.5 to 50 mm	<130°F <54°C
DA301/DA311	General Purpose	5 MHz	.475" 12.1 mm	.050 to 8.0" 1.2 to 200 mm	<140°F <60°C
DA303	High Penetration	2 MHz	.635" 16.2 mm	.20" minimum 5.0 mm minimum	<140°F <60°C

* Actual temperature range depends upon surface condition, and couplant.

NOTE: Probe specifications are subject to change without notice.

5.0 Application Notes

5.1 General Notes

The DME is easy to use and will produce reliable, consistent measurements when used correctly and with an understanding of factors that may affect measurement reliability. This section explains some of the more common considerations.

Flaws

If, during testing, the DME suddenly reads a value which is much thinner than the apparent thickness of the part, it may be reading the distance to a flaw in the test piece, rather than the distance to the backwall. See Section 1.2, How the DME Measures Thickness, for more information. If this condition occurs, the part should be examined with an ultrasonic flaw detection instrument or other suitable NDT method to determine the cause of the suspicious reading.

Surface Conditions

A regular pattern on the surface under test, such as machine grooves, can cause a false thickness reading. Higher frequency probes, such as the DA312, are especially sensitive to this condition. The problem can usually be corrected by rotating the probe so that the crosstalk barrier is at a right angle to the grooves.

It is possible for the surface of a test piece to be too rough to permit a good reading. Excess couplant could be trapped between the probe and surface under test, causing a false reading. A very rough surface may prevent coupling altogether (no coupling indicator). This problem can be corrected by grinding the surface until it is smooth enough to permit good coupling.

Curved Surfaces

When measuring on curved surfaces, e.g. tubes or pipes, keep the probe centered on the part and as stable as possible. Position the crosstalk barrier at right angles to the long axis of the part (Figure 24). As a rule, smaller diameter probes improve coupling and minimize "rocking" on curved parts.

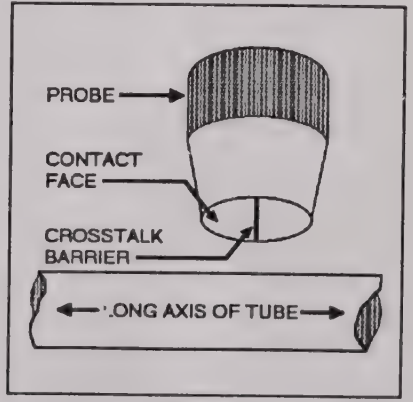


Figure 24

5.2 Thickness Measurement on Hot Test Surfaces

The DME can be used to measure the thickness of materials with surface temperatures of up to 900°F (480°C) with special, high temperature probe model KBA571H. A special high temperature couplant, Krautkramer Branson ZGM, is also required. The following procedure is recommended.

Calibrate the DME according to the procedures in Sections 2.5 - 2.7.

Thoroughly clean the surface to be tested, using a wire brush to remove any oxide layers.

Knead the ZGM high temperature couplant in the tube before using. Then place a drop, about the size of a pea, *on the contact face of the probe, not on the test piece.*

Carefully couple the probe to the surface under test. To prevent damage to the probe face, do not twist the probe while it is in contact with the test surface. On a curved surface be sure to orient the crosstalk barrier as described in Section 5.1. Allow 2 or 3 seconds for the ZGM couplant to melt and provide good coupling. At temperatures above 1020°F (550°C), the ZGM couplant may ignite spontaneously. This will not affect quality of the coupling.

Do not allow the probe to be coupled for more than 5 seconds. If a reading does not appear within 5 seconds, remove the probe and cool it in water. On curved surfaces, gently rocking the probe may help achieve good coupling.

After taking a thickness reading, cool the probe by immersing the contact end in water for a few seconds. Do not leave the probe in the water for an extended time. Before taking another reading, carefully remove remaining couplant and residue from the probe.

Thickness measurements taken at high temperatures must be corrected for the effect of temperature on the velocity of sound in the material. The velocity in steel changes at a rate of −0.5% per 100°F (−1% per 100°C).

Some applications may exceed the capabilities of the DME. If high temperature measurements are unsatisfactory after several attempts using this procedure, better results may be achieved by using a high temperature probe with an ultrasonic flaw detection instrument.

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